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## ECONOMIC FACTORS IN THE SELECTION OF CARS FOR URBAN SERVICE

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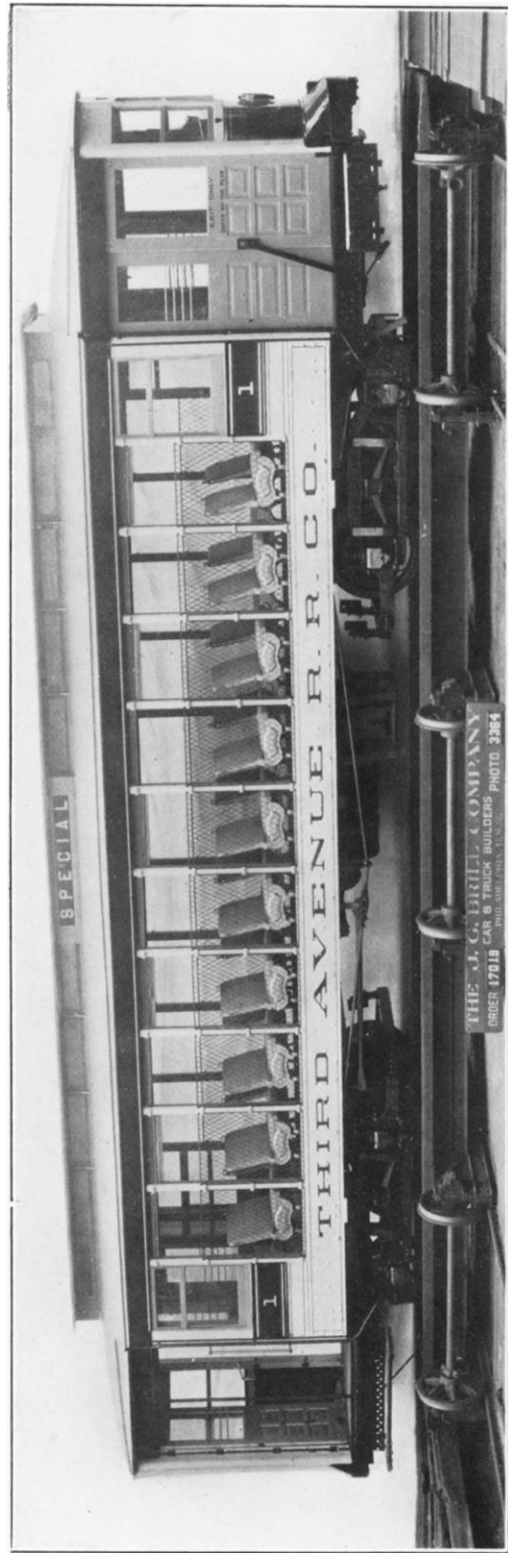
BY SAMUEL M. CURWEN,

Vice-President and General Manager of The J. G. Brill Company,  
Philadelphia.

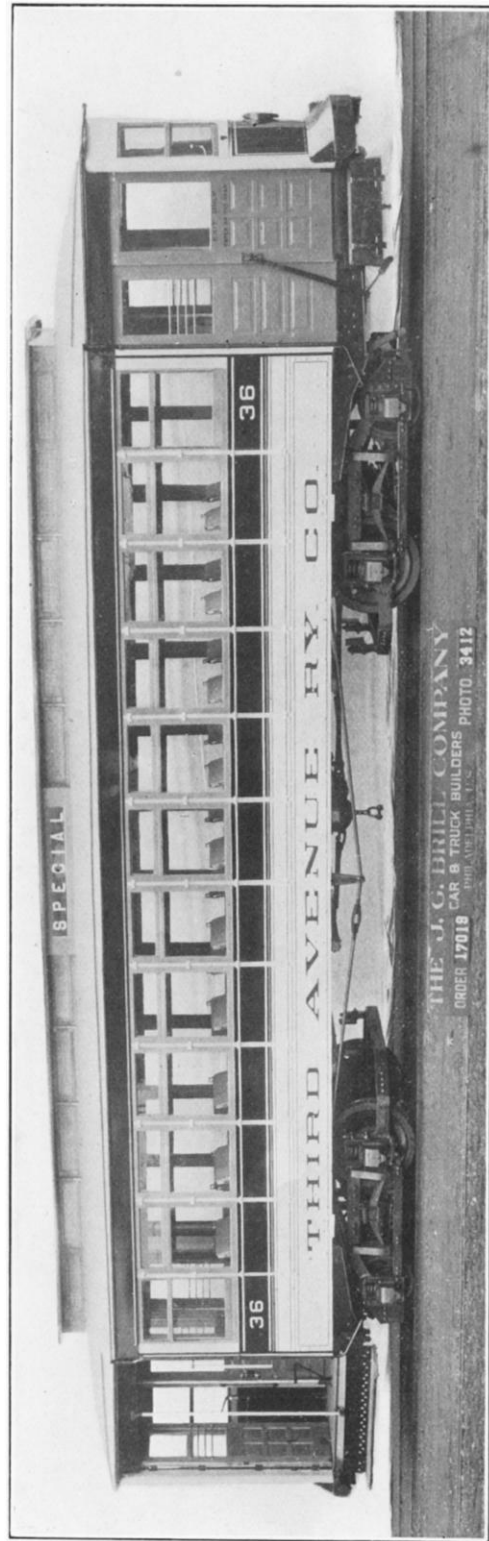
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In a series of articles under the caption, "Conditions Which Govern the Type of Car for City Service," which have been recently published in "Brill Magazine," fifteen of the principal cities of the United States are shown to have a wide variation in types of cars, no two being alike. The lengths of the bodies run from twenty-eight feet to thirty-six feet; the platforms differ all the way from five to eight feet in length, while the centers of the side posts vary from twenty-nine to thirty-four inches. In some types the seats are the longitudinal form of the old days; in others transverse seats are in vogue, and there are a number of mixed transverse and longitudinal seating plans. Weights differ widely in car bodies, trucks and motors, the car bodies differing in some cases several thousand pounds for the same length. Some of these differences, and others not mentioned, are demanded by local conditions; some are the result of local practice, methods and opinions, while some are due to the diversity of principles of design among car builders.

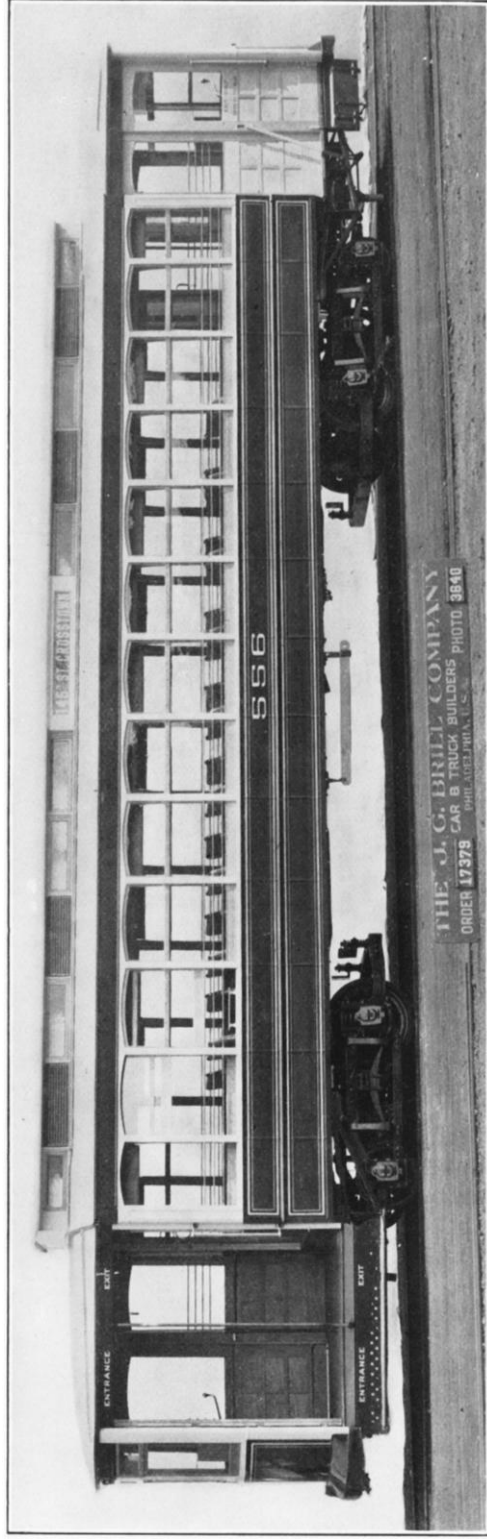
There is, however, a strong trend in the direction of standardization which is being very materially assisted by the consolidation of groups of railroad properties and the rehabilitation of many properties by competent engineers connected with the railways, working with a view to ultimate standardization of all equipment. The American Street and Interurban Railway Association has adopted standards and recommended practices in regard to step heights, wheel measurements, axles, journal boxes, brake shoes, etc., and is extending its good work in other directions through its committees, composed of practical men connected with the railway industries. It is hoped, therefore, that before long, instead of few orders being alike, as at present, there will be a conformity of types and a standardization of principles of design and construction, in whole or in part, reducing the cost of production, operation and maintenance.



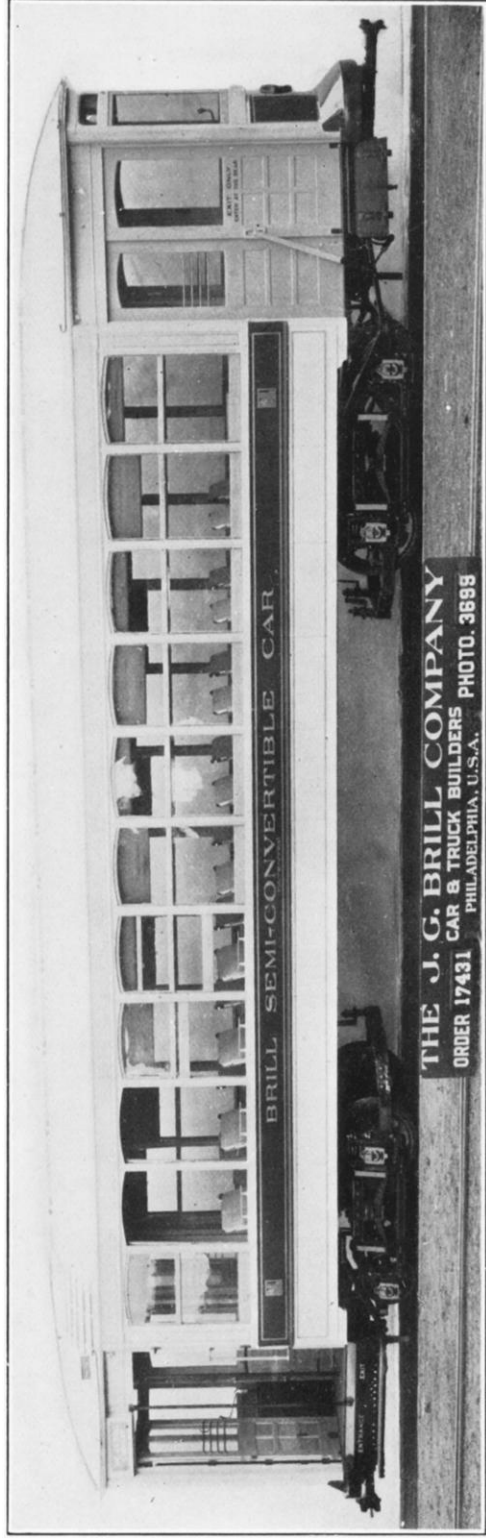
CONVERTIBLE CAR WITH PANELS AND SASHES REMOVED AND METAL SCREENS SUBSTITUTED. MOUNTED ON SINGLE-MOTOR TRUCKS.



CONVERTIBLE CAR WITH REMOVABLE PANELS AND SASHES. FOR WINTER SERVICE THE MOVABLE PARTS ARE LOCKED SECURELY IN PLACE. THE UPPER SASHES ARE ARRANGED TO BE LOWERED.



SEMI-CONVERTIBLE CAR WITH PAY-AS-YOU-ENTER PLATFORMS. STEEL UNDERFRAME. MOUNTED ON SINGLE-MOTOR TRUCKS.



SEMI-CONVERTIBLE CAR WITH PLAIN ARCH ROOF AND PAY-AS-YOU-ENTER PLATFORMS. STEEL UNDERFRAME. MOUNTED ON SINGLE-MOTOR TRUCKS.

The recent progress in the art of building car bodies, trucks, motors and other equipment is creating large advances in efficiency and economy and eliminating the non-essential and freakish features and wasteful practices and principles which have, in one way or another, gained acceptance. There are still too many changes being made to enable one to predict what types will finally be established, but there are evidences in many quarters of a focusing on certain principal dimensions, seating and platform arrangements and on structural designs which will soon obliterate much of the rampant individualism of the last few years.

The greatest differences heretofore have been chiefly in the design of the bottom framing, the arrangement of windows, the seating plan and platform plan, and, above all, in the weight—differences which, generally speaking, do not appear to be necessary. The bottom framing, for a given length of body and for a certain type of trucks and motors, should be of a specific design, determined theoretically and tested practically, to insure the required support and rigidity, with a sufficient margin to resist the maximum stresses of uneven tracks, excessive speeds and extra heavy loads. Trucks and motors have been developed to a stage where there will be little change in dimensions, capacity and general features in the future. Therefore, in these particulars, there is no obstacle which materially bars the way to standardization. The transition from the wood to the steel frame has progressed gradually, and it is probable that the all-steel frame will eventually be used, but this need not prevent certain standard designs of composite frames being adopted for the present.

Out of a great variety of window arrangements two only have continued in general use—the semi-convertible system and the one in which the upper sash is stationary and the lower sash raises. The double-sash window has come into general use on account of its light weight and the desire to reduce the expense of replacement of glass. The semi-convertible window system is considered to be one of the greatest advances made in car design during the past decade, as it provides a large window opening which can be made entirely clear of the sashes at will. The manufacture of open cars has been discontinued for a number of cogent reasons, and the necessity of designing cars for all-year-around service, with ample interior width for comfortable seats and sufficient circulation of air

in summer, has greatly stimulated the introduction of the semi-convertible type. Several arrangements of this kind have been tried, but the one patented by the Brill Company is the only one that has continued to give satisfaction, as it obviates certain distinct disadvantages which handicap the others. The superiority of the Brill device can be best understood by a brief survey of the other methods in use. One method consists of removing the sashes from the car during the summer season, leaving only the curtains for protection against rain and wind. In another, both the sashes are dropped into pockets in the side walls. These pockets reduce the interior width of the car, provide a too-convenient receptacle for rubbish, rendering them extremely unsanitary, allow moisture to penetrate to the framing, and do not afford sufficient protection to the glass. Another arrangement consists of raising the upper sash into a shallow recess and dropping the lower sash into a wall pocket.

In the Brill arrangement both sashes are raised by one operation into a pocket in the side roof. The operation is simple, and the windows can be held at any desired height by a series of stops in the post grooves. By doing away with the wall pockets, the objectionable features just mentioned, especially the reduction of the interior width, are avoided. Moreover, the window sills may be brought low, the standard height being twenty-four and one-half inches above the floor. It is necessary to describe this patented feature belonging to the company which the writer represents, because of the important place which this window system has assumed in car building, a majority of the city cars now in use having this feature.

The transverse seating arrangement is now, and has been for a number of years, used in a majority of city cars, and, as each seat is placed between a pair of side posts, it depends upon the spacing of the posts whether or not the maximum seating capacity is secured. Experience has proved that two-feet-six-inch centers of posts afford sufficient room for a comfortable seating arrangement. This allows the seat to be seventeen and one-half inches wide, and the distance between the seats twelve and one-half inches. In a large number of cases, probably a majority, the seats are fourteen and one-half inches apart, which reduces the seating capacity of a car, with ten or eleven windows on a side, by four passengers. On railways where the narrower and wider spaces between the seats have both been used, there has been found no objection by the riding

public to the narrower spacing, and it would appear that this spacing of two feet six inches between centers of posts could be satisfactorily adopted as standard. On a car with eleven windows on each side, and measuring twenty-eight feet ten inches over the body, the seating arrangement which has given the best results generally consists of seven transverse seats on each side at the center of the car, and longitudinal seats occupying the space of two windows each at the corners. The longitudinal seats provide ample aisle space near the doors to prevent crowding.

The introduction of the pay-as-you-enter type of platform about five years ago in Montreal, and its subsequent adoption in the principal cities of the United States, has proved to be the most radical and beneficial improvement in car construction in the history of city railroading. By placing the motorman in control of the exit of passengers at the front end, and the conductor in control of the exit and entrance of passengers at the rear end, a large percentage of accidents is prevented. The time consumed in stops is cut down to about one-half; there is no missing of fares; speculation on the part of conductors—especially where fare boxes are a part of the equipment—is greatly reduced, and, finally, the comfort of the passengers is increased by eliminating the necessity of having the conductor pass to and fro in the car. The length of the platform enables the average group of people waiting for the car at street corners to be taken aboard before the fares are collected, thus allowing the conductor to watch all of the passengers boarding, and alighting, and enabling him to close entrance doors or gates, if such are used, and ring his signal bell, before commencing the collection of fares. The largest groups are usually taken aboard at transfer points. As a rule, cars are not delayed, however, as the transfer slips are quickly collected.

Naturally, there have been a number of variations in the prepayment-platform scheme, but these variations are in matters of detail and have to do with differences in width of car body, length of platform, and whether the platforms are inclosed with doors or are open.

Platforms of the non-prepayment type are classified as open, half-vestibuled, and vestibuled, the selection usually depending upon the climate. The lengths are from four to five feet, except in the case of cars which are operated at only one end, where it is common to use a

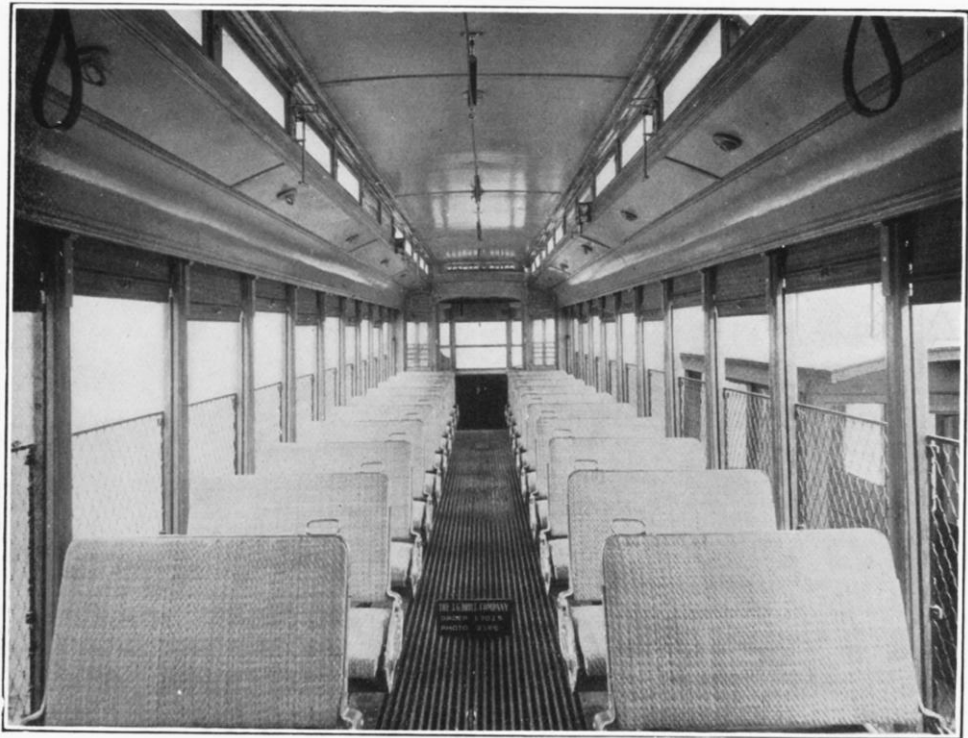
long platform at the rear, usually about six feet in length. The American Street and Interurban Railway Association has recommended uniformity in regard to the step heights.

Until recently car roofs have been of the monitor, or clear-story, type, fitted with ventilator sashes, and in some cases extended over the platform hoods in a manner similar to the well-known steam-car roof construction. The plain arch roof is now making its appearance in this country, after about twenty years of the monitor type, and bids fair to come into general use. The monitor roof is a broken arch, composed of four joints and inherently weak, necessitating a heavier construction than the plain arch form, and in these days, when all parts of the car are being investigated with a view to reducing weight; it is only logical that the roof should come in for a change from an inevitably heavy construction. The plain arch roof, moreover, permits of higher windows, increases the head room very considerably, and, being constructed with what is practically a double roof, has a distinct advantage if used in conjunction with several types of ventilating apparatus. An important consideration, also, which should be kept in mind in comparing the two types of roofs is in the fact that there are no joints in the plain arch roof to furnish access for moisture, the entire roof of the body being covered with canvas, made in a single piece. The plain arch roof costs less to build and, apparently, has every advantage in its favor. It is reasonable to suppose, therefore, that it will be very generally adopted in the future.

The question of cost of electrical operation, which increases very materially with the increased weight of cars, has not until recently been given sufficient attention. Great economies in operation can be gained by proper construction standards, enabling the car builder to build the very lightest car to meet satisfactorily the requirements of the service.

To manufacturers, standardization will reduce the cost of production by eliminating much of the special designing, special patterns, castings, etc. More definite knowledge of the sizes required will permit the laying-in of larger stocks of lumber and steel, with a consequent reduction in cost. It follows, also, that a large percentage of waste will be avoided. It will greatly simplify the drawing of specifications and the facility with which they can be complied with. The buying and selling of cars will be placed on a basis





INTERIOR OF CONVERTIBLE CAR ARRANGED FOR SUMMER SERVICE. SEATING CAPACITY, 45.



INTERIOR OF SEMI-CONVERTIBLE CAR. BOTH UPPER AND LOWER SASHES RAISE INTO ROOF POCKETS.



INTERIOR OF PLAIN ARCH ROOF CAR. SPACE BETWEEN CEILING AND ROOF UTILIZED FOR VACUUM VENTILATING SYSTEM. THIS TYPE OF ROOF PERMITS THE WINDOW OPENINGS TO BE  $4\frac{1}{2}$  INCHES HIGHER THAN STANDARD.

of mutual understanding, deliveries will be made earlier, and the furnishing of repair parts will be facilitated and the cost, at the same time, reduced. All this will benefit the railway company, for, besides reducing the initial cost of equipment and the cost of replacements, it will be productive of economy in the maintenance and engineering departments, and will furnish a lighter and better design of car in most cases. Standardization will also result in the wide recognition and the more speedy adoption of advances made in construction, thereby greatly accelerating the progress of the art of car building.